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ABSTRACT

The usefulness of microcomputers for teaching social science research methods has been the subject of numerous articles. This article describes how microcomputers can be used to teach public policy content, particularly topics involving controversial issues. The discussion is organized into four sections. Section 1, "Four Important Elements," recommends the substantive microcomputer approach for use with class sessions organized in terms of controversial issues where students have access to shared microcomputers each session. It also suggests that, in order to maximize the learning experience, microcomputers be accessible to data files for each controversial issue and that data files have access to software capable of processing data. The other sections are: (2) "Benefits and Objectives"; (3) "Specific Procedures"; and (4) "Miscellaneous Pointers for Teaching Subjects with Microcomputers." (KWL)

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USING MICROCOMPUTERS FOR TEACHING

by Stuart Nagel, University of Illinois

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USING MICROCOMPUTERS FOR TEACHING

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A number of articles explain how useful microcomputers can be for teaching social science research methods, particularly statistical analysis, because students can quickly obtain output from archived or inputted data and experiment with changing inputs and procedures to gain insights into various aspects of statistical analysis. Instructors combine this with lectures and discuss what is or should happen, and help students organize data, draft reports, retrieve information, and interact with others. This article describes a way microcomputers can be used to teach public policy substance, rather than methods or office practice, especially involving controversial issues.[1]

Four Important Elements

Ideally, the substantive microcomputer approach works with: 1) class sessions organized in terms of controversial issues; 2) students with access to shared microcomputers each session; 3) microcomputers accessible to data files for each controversial issue; and 4) data files having access to software capable of processing the data in a way that maximizes the learning experience.

Given the nature of public policy, arranging for a variety of controversial issues is easily done, and is a desirable approach to teaching, regardless of whether one is using microcomputers. There are textbooks for many courses organized in terms of controversial issues such as Leslie Lipson, *The Great Issues of Politics: An Introduction to Political Science* (Prentice-Hall, sixth edition, 1981), Herbert Levine, *Political Issues Debated: An Introduction to Politics* (Prentice-Hall, 1982) and George McKenna and Stanley Feingold (eds.), *Taking Sides: Clashing Views on Controversial Political Issues* (Dushkin, second edition, 1981). Any course dealing with constitutional law or court cases inherently deals with controversial issues, manifested in the maiority, concurring, and dissenting opinions.

If there is a shortage of microcomputers, have three or five students share a microcomputer, using a round table so each may have access to the keyboard. It is less expensive than a one-on-one arrangement, and also provides a better learning experience because they tend to help and reinforce each other. Arranging for hardware is easily done by virtue of the availability of IBM PC portables at many universities for approximately $1,000 with discounts; so for $10,000, one can obtain enough hardware to service large classes of 50 students apiece.

A data file arrangement, in this context means a matrix showing 1) alternatives to choose among on the rows; 2) criteria or goals on the columns; and 3) relations between alternatives and criteria in the cells. Such

a matrix can facilitate debating, discussion, and choosing the best alternative, combination, or allocation. There are now almost 200 such data files available for issues that relate to political science, public policy, and law. They are available from Decision Aids, Inc., 1720 Parkhaven Drive, Champaign, IL 61820. The data relate to such institutional issues as federalism, separation of powers, judicial review, party systems, democracy versus dictatorship, and socialism versus capitalism. The data files also relate to public policy controversies in the realm of agriculture, civil liberties, criminal justice, defense, economic regulation, education, energy, environmental protection, foreign policy, health, housing, labor, minorities, women, poverty, technology, transportation, and zoning. The data files also relate to numerous Supreme Court cases, and using the format of these data files stimulates instructors to develop more data files, including ones of special relevance to their courses.

Arranging for software to process such data, should include: 1) allowing changes in the alternatives, criteria, and relations in order to facilitate experimenting and creativity; 2) showing what alternative, combination, or allocation is best in light of (a) the alternatives available, (b) the criteria and their relative weights, and (c) the relations between the alternatives and the criteria and 3) showing what changes would be necessary to bring a second-place alternative up to first place. For that kind of software, obtain a copy of Policy/Goal Percentaging software from Decision Aids, Inc., along with the 200 data files for only $20, including a Datafiles Manual, a Program Manual, and summarizing articles. The program is called Policy/Goal Percentaging because it relates policies or alternatives to goals or criteria, and it uses part/whole percentaging to deal with the criteria being measured in different ways. The software is capable of processing the alternatives, criteria, and relations for any substantive problem to indicate the best alternative, combination, or allocation in light of those alternatives, criteria, and relations. The software is also capable of flexibility in allowing additions, subtractions, and other changes in the alternatives, criteria, and relations. It can also indicate what changes are needed in order to bring the second-place alternative up to first place.[2]

Benefits and Objectives

Microcomputers provide additional benefits for teaching purposes beyond good teaching materials and class sessions. They are useful for students to absorb information through interactive questions and answers, and for role playing to develop various skills and procedures. They stimulate student creativity by allowing them to easily input new data, ideas, and methods, and can be used along with lectures, discussion, textbooks, and other traditional teaching devices. The relevant hardware is becoming less expensive and more widely available, and there is an increasing quantity of software being developed for a variety of courses in political science, policy studies, public administration, and related fields. Finally, faculty and trainers are becoming more knowledgeable about the potential of microcomputers, and students are becoming more receptive to using them.

Using microcomputers for teaching either methods or substance in undergraduate or graduate courses has a significant impact on education. At the 1984 annual meeting of the American Society for Public Administration, I lectured at an all-day workshop dealing with decision analysis in public

administration. In participant evaluations, however, they complained about the lack of participation. At the 1985 ASPA annual meeting, I conducted the same all-day workshop, but this time with microcomputers and hands-on experience, and the participants were enthralled by the experience of working with microcomputers, and in oral and written evaluations they commented favorably.

In the context of teaching public policy analysis or political science, there are several learning objectives in which microcomputers facilitate role playing. They enable students to process a set of policy goals to be achieved, available alternatives for achieving them, and relations between goals and alternatives in order to choose the best one. Another objective is met by enabling students to deal with such policy analysis problems as multiple dimensions on multiple goals, multiple missing information, too many multiple alternatives to determine the effects of each one, multiple and possibly conflicting constraints, and the need for simplicity in spite of multiplicity.

They also enable students to handle sensitivity analysis to determine the bottom-line conclusion in a policy analysis that is likely to change as a result of changes in goals, alternatives, relations, weights, constraints, and especially the various ways of handling the analytic problems mentioned above. The courses also allow students to work with microcomputers to facilitate a fast, meaningful handling of inputs and procedures. A final objective is reached by teaching students to report results of these policy analysis activities in a clear and helpful way to governmental decisionmakers and other political scientists.

Specific Procedures

To further stimulate involvement where there are five students per microcomputer, the students can be grouped in terms of their ideological or substantive interests. For example, with 25 students, the five sets might cover relatively strong liberals, mild liberals, neutrals, mild conservatives, and relatively strong conservatives. To facilitate interaction across such groups, students should be encouraged to suggest new alternatives, criteria, and relations to the other groups, facilitating innovative compromises perhaps better than the expectations of either side. Or, instead of dividing students into ideological groups, they can be divided in terms of their substantive interest, which is especially useful if the groups create their own data files.

An important point is that the data files do not require precise quantitative data. One can do meaningful analyses when relations are expressed on 1-2 (no-yes) scales, or 1-3 (no-maybe-yes) scales, or more precise scales relating to years, miles, dollars, percentages, or other measurement units. The software is capable of dealing with a variety of measurement units by such methods as converting them all to 1-5 scales or part/whole percentages. The software also demonstrates there is no need to argue over whether a relation is scored 60 or 80 because anything above 45 arrives at the same results. The software can handle missing information by determining critical values, above which the decision would go one way and below which another way. One then merely has to determine whether an item is above or below that threshold, rather than determine the item's exact score. The software also handles problems where the number of alternatives is too great to determine the effects of each one, and where conflicting constraints are present.

An illustrative problem might be how to provide legal services for the poor, as part of a political science course on the judicial process. The class might go through the following steps to create a new data file rather than

manipulating an existing one:

1. Begin with some policies and goals. For example, the alternative policies might be salaried government lawyers versus unpaid volunteers. The goals might be inexpensiveness, accessibility, political feasibility, and competency.
2. Add to the policies and the goals in light of the initial set.
3. Consolidate policies and goals that heavily overlap, indicated by the fact that they have the same relation scores.
4. Divide policies and goals if the initial wording may have been too gross.
5. Insert relation scores using pluses and minuses. Go down one column or goal at a time to promote consistency within each goal.
6. Convert the pluses and minuses into numbers on 1-3 or 1-5 scales. Revise the relation scores if finer distinctions are necessary, such as a score of 2.5.
7. Decide on tentative weights for the goals by giving the least important goal a weight of 1, and expressing the weights of the other goals as multiples of the first goal. Do not weight the goals if they all seem equally important or if the weighting seems too difficult. The weighting can be postponed until after the results, because perhaps different weights will not change the results. The results may also clarify how much difference there has to be in order to change the results.
8. Sum across each policy in order to determine its overall score. If the goals have different weights as multipliers, then sum the products across each policy. Each product involves the relation score multiplied by the weight of the goal to which it pertains.
9. Observe the unweighted or weighted summation scores to see if there is one outstanding policy, a scattered combination of outstanding policies, or an optimum level pattern where doing too little or too much is undesirable.

Relevant questions for exams and class might relate to the following:

1. What changes in the relative weights of the criteria (or changes in the scores of the alternatives on the criteria) are needed in order to make a second place alternative into first place? For example, given the data file on the Supreme Court case of *Ballew v. Georgia,* how much and why does the weight of avoiding a wrongful conviction have to rise from 1.00 relative to the weight of avoiding a wrongful acquittal in order for a 12-person jury to be optimum, a 6-person jury, or a single decisionmaker?
2. What are the effects of adding or subtracting a criterion or alternative on the bottom-line solution as to which alternative is best? For example, given the data file on the effects of alternative means of resolving criminal cases, how and why would the initial allocation change between trials and plea bargains if expense is added as a criterion to delay reduction and respect for the law, or if diversion is added as an alternative means of resolving cases.
3. What changes in the alternatives, criteria, or relations are needed to have a predictive analysis conform to known reality as to how liberals, conservatives, or others tend to decide a certain controversial issue? For example, what criteria might be added and with what weights in order to understand why liberals are generally opposed to capital punishment and conservatives are generally in favor of capital punishment?

Miscellaneous Pointers for Teaching Subjects with Microcomputers

1. Provide each student with a copy of the program and the data files at the beginning of the semester, so they can work with them easily

outside of class.

2. Before the end of the semester each student should submit a short paper analyzing a data file they have created on a subject interesting to them. Preparing short memos is even more important in a methods course than a substance course in order to encourage the students to apply the methods.
3. Midterm and final exams should be given in the the classroom with the microcomputers, though students may need to take them in shifts to aid in developing the answers or analysis for each problem. Questions in class should involve the use of microcomputers.
4. At least in the beginning of the semester, the instructor should guide the students collectively through the analysis of selected substantive problems instructing them on the keyboard.
5. Arrange for different parts of the class to experiment with various alternatives, criteria, or relations. For example, the liberal, independent, and conservative groups separately clarify their respective positions and observe relatively weak elements in the diverse conclusions to develop mutually satisfying compromises.
6. Expect students to create and manipulate data files in homework assignments, then examine and discuss them in class.
7. Students should experiment with the data files being discussed during class, and raise questions and comment about their experiences — in this case it is a sign of interest if all the computers are going while the instructor is talking!
8. At the beginning of class, announce the two or three data files to be discussed. Doing so prepares students for the day's activities, helps keep them on schedule, or outline what must be covered in the next class if something is left over, and encourages processing data files more than traditional lecturing.
9. Students learn better if they combine working with microcomputers at their seats and observing the microcomputer display on a monitor or a projector controled by the instructor, though a projector may be somewhat of a distraction. It is helpful to have the monitor projector display alternatives to the criteria for the big picture, rather than focus just on the alternatives or criteria separately.
10. Occasionally, the class should develop datafiles collectively, working out the alternatives, criteria, relations, and analysis. An exciting, but risky way is to do it spontaneously, not working out those inputs in advance, so students benefit by development of new knowledge, rather than just absorbing what has already been developed.
11. If pressed for time when discussing a data file, go quickly to initial bottom-line analysis and the threshold or break-even analysis, rather than dwell on preliminary inputs.
12. Term papers are not essential to provide students with experience in using microcomputers, since they should have plenty of that in the classroom.
13. Decision matrices enable students to better understand how to make decisions, to explain or influence other people's decisions and especially to examine the various goals, alternatives, relations, and conclusions for any substantive problem.

Some Conclusions

The Policy/Goal Percentaging approach represents a synthesis between inductive and deductive reasoning and between empiricism and rationalism,

since the relations between policies and goals tend to be based on experience, although generally not statistical correlation analysis. The overall analysis is deductive with a prescriptive conclusion deduced from premises relating to goals, alternatives, and relations, often based on surveying decisionmakers or their writings, a form of empirical analysis. They may sometimes be deduced from other propositions about related relations, goals, and alternatives, but perhaps most important is the emphasis Policy/Goal Percentaging places on sensitivity analysis. It does not tell us what the truth is, however, it may point out there is no difference on the bottom-line of what policy to adopt whether a controversial relation or goal weight is a 64 or an 83. In other words, empiricism tells us the reasonable ranges for input scores, but deduction tells us at what threshold within those ranges a score changes the results.

By its emphasis on sensitivity analysis, the Policy/Goal Percentaging teaching approach stimulates students to constantly think about adding, subtracting, or otherwise changing the alternatives, the minimums and maximums of the alternatives, the goals and their measurement units or weights, and their minimums and maximums and any budget allocation. It is conducive to creativity as well as careful reasoning, and perhaps colleges need to encourage this. The investment of time and money to teach with microcompters is low compared to the benefits.

NOTES

1. On Using Microcomputers as a teaching tool, see Kenneth Kraemer, "Curriculum Recommendations for Computers in Public Management Education," (NASPAA, 1984); Herbert F. Weisberg, "Microcomputers in Political Science," (Summer, 1983); Fiona Chen, "Teaching Computer Application in Public Administration," (Eastern Washington University, School of Public Affairs, 1984); and S. Nagel, "Microcomputers and Public Policy Analysis," in Don Calista (ed.), *Microcomputers and Public Productivity* (Special issue of the Public Productivity Review, 1985).

2. On the Policy/Goal Percentaging software, see Benjamin Radcliff, "Comparing Multiple Criteria Decision-Making Programs," 4 *Social Science Microcomputer Review* (1986); S. Nagel, "Policy/Goal Percentaging Analysis: A Decision-Aiding Program," 3 *Social Science Microcomputer Review* 243 (1985); and S. Nagel, *Microcomputers, Evaluation Problems, and Policy Analysis* (Sage, 1986).

3. Background material exists on teaching from a perspective of societal goals to be achieved for choosing the best alternative, combination, or allocation. See, for example, the opening chapter to S. Nagel, *Public Policy: Goals, Means and Methods* (St. Martin's, 1984) and the accompanying Instructor's Manual. Also see S. Nagel, "Using Microcomputers and Policy/Goal Percentaging for Teaching Policy Analysis and Public Policy," in Peter Bergerson and Brian Nedwek (eds.), *Teaching Public Admnistration* (Programs in Public Policy Analysis and Administration, St. Louis University, 1985).

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